

REMARKS/ARGUMENTS

Claims 13, 14, 16 and 19-31 are pending. By this Amendment, claim 15 is cancelled, claims 13 and 19 are amended, and new claims 30 and 31 are presented. Support for the amendments to claims 13 and 19 can be found, for example, in original claims 13, 15 and 19. Support for new claims 30 and 31 can be found, for example, in original claims 9 and 26. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Gislason and Ino

The Office Action rejects claims 13-16 and 20-29 under 35 U.S.C. §103(a) over U.S. Patent No. 6,914,033 to Gislason et al. ("Gislason") in view of U.S. Patent No. 5,268,346 to Ino et al. ("Ino"). By this Amendment, claim 15 is cancelled, rendering the rejection moot as to that claim. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 13 recites "[a] process for producing hydrogen, comprising: desulfurizing a hydrocarbon fuel by contacting the hydrocarbon fuel to an adsorbent comprising cerium oxide, primary particles of the cerium oxide having a mean crystallite size of 10 nm or less; and subsequently bringing the desulfurized fuel into contact with a catalyst comprising at least one member selected from the group consisting of a partial-oxidation reforming catalyst, an autothermal reforming catalyst, and a steam reforming catalyst; wherein neither hydrogen nor oxygen is added while desulfurizing the hydrocarbon fuel" (emphasis added). Gislason and Ino do not disclose or suggest such a process.

As indicated above claim 13 requires that neither hydrogen nor oxygen be added while desulfurizing the hydrocarbon fuel. Gislason discloses that desulfurization is carried out in the presence of hydrogen. *See Gislason*, column 13, line 60 to column 14, line 7. In each of the examples of Gislason, hydrogen is introduced during desulfurization. *See*

Gislason, column 16, lines 38 to 40, column 17, lines 45 to 47, column 18, lines 24 to 26.

Gislason does not disclose or suggest that desulfurization can be carried out without adding hydrogen. Ino discloses that desulfurization may be carried out by hydrodesulfurization – a desulfurization process in which hydrogen is added during desulfurization. See Ino, column 4, lines 36 to 40. Ino includes no teaching or suggestion of carrying out desulfurization without adding hydrogen.

As neither Gislason nor Ino discloses or suggests a desulfurization during which neither hydrogen nor oxygen is added, the combination of references fails to disclose or suggest each and every feature of claim 13.

Gislason discloses that gasoline containing 50 ppm or less of sulfur can be desulfurized to a level of 9 ppm or less of sulfur. See Gislason, column 2, lines 58-64; Table II. That is, it appears from the disclosure of Gislason that the disclosed desulfurization methods obtain, at best, a level of 9 ppm or less of sulfur. By contrast, the method of claim 13 can obtain a desulfurization level of 0.1 ppm or less of sulfur. This is a remarkable improvement over a desulfurization level of 0.1 ppm or less of sulfur. The desulfurization process of Gislason, in which desulfurization is accompanied by hydrogenation, cannot achieve a desulfurization level of 0.1 ppm, as can be achieved by the process of claim 13.

As described above, the desulfurization level in Gislason is poor and, accordingly, one of ordinary skill in the art of desulfurization of hydrocarbons would not consider using the process of Gislason to desulfurize hydrocarbons for use in a process for the preparation of hydrogen, because in such processes sulfur content must be lowered to a very small value (e.g., 0.1 ppm or less). See also discussion of claim 19 below (this rationale would also prevent a skilled artisan from employing the features of Gislason in a fuel cell system).

Applicants submit that, after desulfurizing by the process of Gislason, one of ordinary skill in the art could not reasonably expect sulfur content levels below 5 or 6 ppm. Additional sulfur

would not be removed by performing the steam reforming process of Ino. Thus, even if the teachings of Gislason and Ino were combined, such combination would not yield the process of claim 13.

Ino discloses a catalyst including cerium and ruthenium for use in steam reforming of hydrocarbons. There is no disclosure or suggestion in Ino of using the disclosed catalyst in a desulfurization process that precedes a reforming process, as recited in claim 13. Steam reforming of hydrocarbons is a different process from desulfurization of hydrocarbons in terms of reaction mechanism and reaction category. As is well-settled, a *prima facie* case of obviousness based on a proposed modification to a reference (e.g., replacing the catalyst of Gislason with the catalyst of Ino) will only stand if one of ordinary skill would have had a reasonable expectation of success upon making the modification. *See, e.g.*, MPEP §2143.02 (citing *In re Merck & Co., Inc.*, 800 F.2d 1091 (Fed. Cir. 1986)). One of ordinary skill in the art would have had no reason to expect that the steam reforming catalyst of Ino could function desirably in a desulfurization process as disclosed in Gislason.

Claim 13 would not have been rendered obvious by Gislason and Ino. Claims 14, 16 and 20-29 depend from claim 13 and, thus, also would not have been rendered obvious by Gislason and Ino. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

#### Ino and Gislason

The Office Action rejects claims 13-16 and 20-29 under 35 U.S.C. §103(a) over Ino in view of Gislason. By this Amendment, claim 15 is cancelled, rendering the rejection moot as to that claim. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 13 is set forth above. For the reasons discussed above, Ino and Gislason fail to disclose or suggest each and every feature of claim 13.

Claim 13 would not have been rendered obvious by Ino and Gislason. Claims 14, 16 and 20-29 depend from claim 13 and, thus, also would not have been rendered obvious by Ino and Gislason. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Gislason, Ino and Shore

The Office Action rejects claim 19 under 35 U.S.C. §103(a) over Gislason in view of Ino and U.S. Patent No. 6,541,419 to Shore et al. ("Shore"). Applicants respectfully traverse the rejection.

Claim 19 recites "[a] fuel cell system, comprising: a desulfurizer; and a reforming apparatus; wherein: the desulfurizer comprises an adsorbent comprising cerium oxide having primary particles with a mean crystallite size of 10 nm or less, the desulfurizer being configured so that a hydrocarbon fuel can be contacted to the adsorbent; and the reforming apparatus comprises a catalyst comprising at least one member selected from the group consisting of a partial-oxidation reforming catalyst, an autothermal reforming catalyst, and a steam reforming catalyst, the reforming apparatus being configured so that a desulfurized fuel can be contacted to the catalyst; wherein neither hydrogen nor oxygen is added when desulfurization is performed" (emphasis added). Gislason, Ino and Shore fail to disclose or suggest such a system.

As discussed above, neither Gislason nor Ino discloses or suggest a process in which neither hydrogen nor oxygen is added during desulfurization. The Office Action relies on Shore for its disclosure of a fuel cell system. *See* Office Action, page 2. However, Shore, like Gisalson and Ino, fails to disclose or suggest a process or system in which neither hydrogen nor oxygen is added during desulfurization. Accordingly, even if the references

were combined as proposed in the Office Action, a fuel cell as recited in claim 19 would not be obtained.

Claim 19 is would not have been rendered obvious by Gislason, Ino and Shore. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Ino, Gislason and Shore

The Office Action rejects claim 19 under 35 U.S.C. §103(a) over Gislason in view of Ino and U.S. Patent No. 6,541,419 to Shore et al. ("Shore"). Applicants respectfully traverse the rejection.

Claim 19 is set forth above. For the reasons discussed above, Ino, Gislason and Shore fail to disclose or suggest each and every feature of claim 19.

Claim 19 would not have been rendered obvious by Ino, Gislason and Shore. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

New Claims 30 and 31

By this Amendment, new claims 30 and 31 are added. Claims 30 and 31 recites that the cerium oxide employed in the process of claim 13 and the system of claim 19 is obtained by calcining at a temperature of from 120 to 400 °C. The cited references do not disclose or suggest employing such a cerium oxide. Moreover, Examples 12-15 of the present specification demonstrate that such a cerium oxide possesses superior desulfurization properties not present in cerium oxides obtained by other methods. *See* present specification, page 28, Table 4.

Conclusion

For the foregoing reasons, Applicants submit that claims 13, 14, 16 and 19-31 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

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